



## A9. Flood Damage Reduction

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Attachment 9 identifies the flood damage reduction benefits attributed to the seven projects proposed for implementation in the Santa Barbara County Region Proposition 84 (Prop 84) IRWM Implementation Grant Application – Round 1 (Proposal).

### **Flood Damage Reduction**

The Proposal contributes to the long-term reduction in flood damages. This will be accomplished through a project that reduces the potential for flood events to damage residential and commercial property, generate emergency response costs, and cause a loss in net income and revenue. The flood control project in this Proposal is located in the Old Town area of Goleta (a DAC). It gives the area improved flood protection, a more sustainable flood management system, an enhanced ecosystem, and improved wetlands and ocean water quality.



## **PROJECT 4:**

City of Goleta, San Jose Creek Capacity Improvement and Fish Passage Project



## Project 4: City of Goleta, San Jose Creek Capacity Improvement and Fish Passage Project

The San Jose Creek Capacity Improvement and Fish Passage Project (Project 4 or Project) will consist of the removal and reconstruction of the San Jose Creek Flood Control Channel. When completed, this multiobjective Project will increase flood conveyance capacity, reduce flood hazard, and provide fish passage for migrating endangered steelhead trout (steelhead). This Project is a cooperative effort between the City of Goleta and Santa Barbara County Flood Control District that will remove residential, commercial, and industrial properties from the regulatory flood plain. The new channel will include an articulated concrete revetment bottom and an internal fish passage channel that will allow for fish passage during low-flow events, reduce water quality impacts to the Goleta Slough, and increase groundwater recharge.

“Old Town Goleta” has been repeatedly damaged by overflows from San Jose Creek during flooding events. The most recent serious flooding events calling for Federal Emergency Management Agency Declarations of Emergency occurred following storms in 1995 (numbers 1044 and 1046) and one in 1998 (number 1203). This Project is needed to reduce the threat to public safety and property from flooding as a result of greater than 25-year events. When San Jose Creek overflows its banks, the entire downtown area, which is a DAC, is affected. The flooding devastates homes and businesses, significantly disrupts transportation, requires public resources, and carries contaminants to Goleta Slough and the Pacific Ocean. The goal of the flood control portion of this Project is to protect the “Old Town Goleta” from flooding and associated damages. The benefits associated with the Project are summarized in Exhibit 9.4-1. A comparison of the costs and benefits is provided in Exhibit 9.4-2.

### EXHIBIT 9.4-1

#### Project 4 Benefit Overview

Type of Benefit	Assessment	Beneficiaries
<b>Water Supply Benefits (Attachment 7)</b>		
Increased groundwater supply	Quantitative	Local
<b>Water Quality and Other Expected Benefits (Attachment 8)</b>		
Water quality	Qualitative	Local
Aesthetic	Qualitative	Local
Environmental	Qualitative	State
<b>Flood Damage Reduction</b>		
Avoided flood damages	Monetized	Local

**EXHIBIT 9.4-2**

Project 4 Benefit and Cost Summary

Type of Benefits/Costs	Present Value
<b>Capital and O&amp;M Costs</b>	\$22,774,512
<b>Quantitative Benefits</b>	
Avoided flood damages and other costs	\$54,252,000
<b>Qualitative Benefits</b>	<b>Qualitative Indicator</b>
Increased groundwater supply	+
Water quality	+
Aesthetic	++
Environmental	++
+ indicates net benefits are likely to increase	
++ indicates net benefits are likely to increase significantly	

## Costs

The construction cost for the Project will be \$23,411,088. Construction costs will be incurred over 3 years, 2011 through 2013. Annual administration (\$18,000), operation (\$40,000), maintenance (\$100,000), replacement (\$60,000), and other costs (\$2,000) will begin in full in 2014. The total present value of costs for the Project over its useful life is \$22,774,512 (Table 17-4).

## Flood Damage Reduction Benefits

### Avoided Physical Damage

The existing San Jose Creek channel has a 25-year storm event capacity, and “Old Town Goleta” has been repeatedly damaged by overflows from San Jose Creek during flooding events. Two serious events occurred in 1995 and one in 1998, causing significant damage. It is estimated that, without the Project, there is a 25 percent probability that a 100-year flood event would cause serious flooding, damaging \$117 million in property and clean-up costs (Exhibit 9.4-3). With the Project, the probability of property damage from flood events between 25 and 100 years would be reduced to zero.

Residential damages were estimated following Army Corp of Engineer methods. Housing characteristics were similar in age and type to the area assessed in the Flood Damage Analysis: Santa Maria Levee Project (Appendix 9-4). Therefore a similar analysis was undertaken to estimate damages for structures in the area affected by 25-, 50-, and 100-year flood events (Appendix 9-4, Flood Damage Calculations).

**EXHIBIT 9.4-3**

Project 4 Flood Damage Estimates (\$ million)

Type of Damage	25-Year	50-Year	100-Year
Residential	\$84	\$67	\$47
Commercial	\$17	\$17	\$17
Infrastructure	\$11	\$11	\$11
Clean-up	\$5	\$7	\$8
Total	\$117	\$102	\$83

Commercial damage estimates consist entirely of five car dealerships in the area affected during 25-year flood events. Based on lot size and number of vehicles, City staff estimated the value of inventory loss during a 25-year flood event to be \$17 million. Infrastructure damages were estimated using Caltrans lane rental (i.e., estimated loss of road use cost) and accelerated roadway depreciation due to flooding in areas affected during 25-year events (Appendix 9-4, Infrastructure Damage Calculations). Although conservative, both commercial and infrastructure damage estimates do not increase during 50- and 100-year flood events. Based on the area inundated during 25-, 50-, and 100-year flood events, clean-up costs were estimated by the City's design engineer.

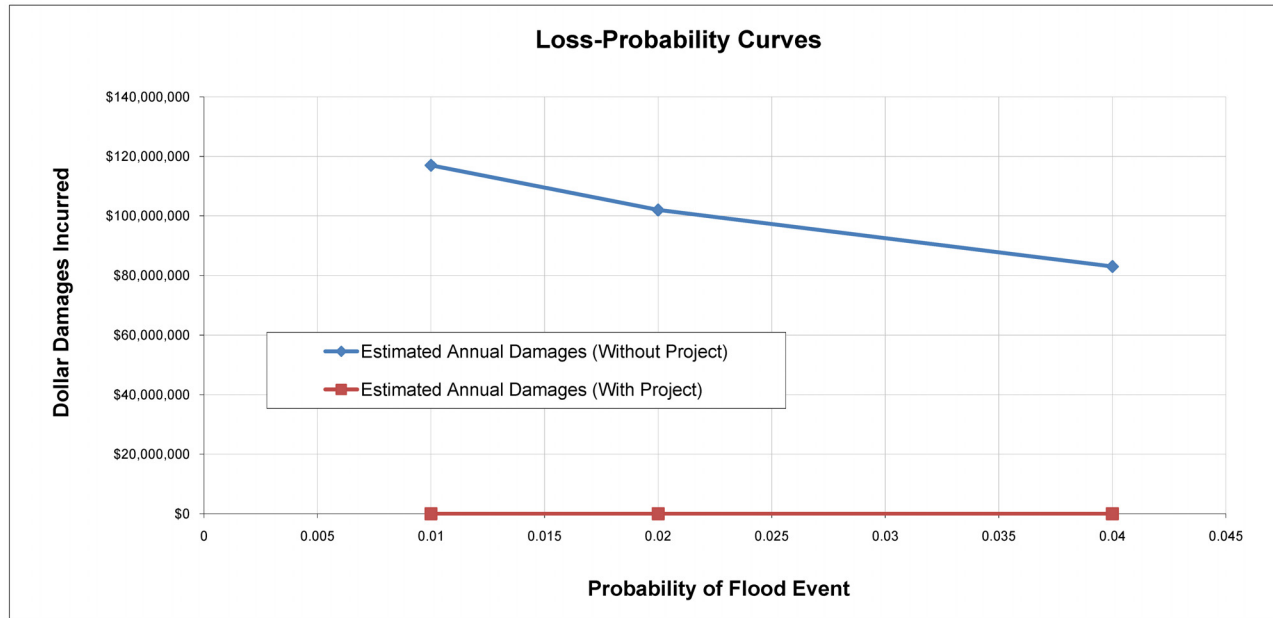
To estimate the avoided damages from implementing the Project, three hydrologic events were selected, 25-, 50-, and 100-year events. The estimated probability of the hydrologic event, the probability of channel failure during the event, and the expected damages and clean-up costs, with and without the Project (Table 18A-4) were used to create loss-probability curves (Exhibit 9.4-4). The difference in the area under the two curves represents the expected damage reduction benefit of the Project (Exhibit 9.4-1). The expected annual avoided damage benefit from the Project is \$4.115 million. The total present value of benefits over the life of the Project total \$53.636 million (Table 19-4).

**Avoided Emergency Response**

The emergency response cost for the two 1995 San Jose Creek flood event was estimated by the City of Goleta's Community Service Director to be approximately \$1,000,000. Based on historic flood events, City staff estimated emergency response cost for a 100-year flood would be in excess of \$1 million. Conservatively estimating emergency response costs at \$100,000, \$500,000, and \$1,000,000 for 25-, 50-, and 100-year flood events, respectively (Table 18B-4), the benefit of reducing expected emergency response costs over the life of the Project will total \$306,308.

#### EXHIBIT 9-4

##### Project 4 Loss-Probability Curves



#### Avoided Net Income Loss

“Old Town Goleta” has been repeatedly damaged by overflows from San Jose Creek during flooding events. Two serious events occurred in 1995 and one in 1998, causing significant damage. The City of Goleta estimates that the lost net income per day in the potential affected area for business would be \$24,180, while the lost net income per day for residents in the affected area would be \$89,124 (Appendix 9-4, Income and Revenue Loss Calculations). It is a conservative estimate that business activity and services would be suspended for at least 1 week following a 100-year event, 5 days for a 50-year flood event, and 3 days for a 25-year flood event). Again, using the same methodology used to estimate the expected annual avoided physical damage (Table 18C-4), the benefit of the avoided annual lost net income over the life of the Project totals \$310,140.

#### Avoided Public Safety and Health Impacts

Historic flood events have resulted in flooded businesses and residences, as well as mud inundation. In addition, vehicles have been swept away in floodwaters, and emergency access has been severely constrained. As a result of this, flood water contamination, safety and health concerns related to mold and water borne diseases, and vehicle entrapment have created significant flood impacts. The Project will likely avoid these negative outcomes during 100-year (or lesser) flood events. Project 4 will also maintain access to the Santa Barbara Municipal Airport.



## **Distribution of Benefits and Identification of Beneficiaries**

The direct beneficiaries of the Project will be residents and business owners in “Old Town Goleta,” which is a DAC. Future damages from a flooded San Jose creek channel will be avoided. Overall, the residents of “Old Town Goleta” will benefit from a forecasted increase in investment in the area and residents of the City at large will also benefit from a potential increase in tax revenue and reduction in emergency services required in this portion of the City. Residents of California will benefit from the avoided emergency response costs and the avoided transportation disruption along Highway 101.

## **Benefits Timeline**

The estimated life of the Project is 78 years. Benefits will begin in full in year 2014, after 3 years of construction beginning in 2011.

## **Potential Adverse Effects**

Temporary impacts as a result of Project will occur during the construction phase, and they will be mitigated. The Project will occur within the existing flood control channel and along the 7-foot-wide right-of-way purchased from the California Department of Transportation (Caltrans). The land purchased from Caltrans has no independent utility and is not currently used for any beneficial purpose; its only value is as part of Highway 217. Including it as part of the flood control channel will have no impact on Highway 217, and no long-term impacts are expected with the Project.

## **Summary of Findings**

The primary benefit from the Project will be avoided damage from flooding of “Old Town Goleta.” The avoided damages, emergency response costs, and lost net income for the flood control Project will provide \$54.252 million in expected benefits. However, this estimate is conservative. Unaccounted-for damages include residential vehicle damage, regional transportation delays, and damage to large businesses in the affected area such as ATK and UPS facilities.

## **Uncertainties**

The estimate of lost net business and individual net income is uncertain. The suspension of business activity and services following a significant flood event may be longer than the proposed 7 days. Even if business activity is more quickly restored, it would likely operate at limited capacity for an extended period of time. Therefore, the avoided loss in net income estimates may underestimate the benefits.

Flood damage estimates are also uncertain. Global climate change could significantly affect historic hydrology. If storm events become larger and more frequent, the benefits from avoided flood damages will increase.



Table 17-4, Annual Cost of Project (Costs in 2009 Dollars) Project 4: City of Goleta, San Jose Creek Capacity Improvement and Fish Passage Project									
	Initial Costs	Operations and Maintenance Costs (1)						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total cost From Table 7 (row (i), column (d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs  (a) +...+ (f)	Discount Factor	Discounted Costs  (g) x (h)
2009	\$0	\$0	\$0	\$0	\$0	\$0	\$0	1.000	\$0
2010	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0.943	\$0
2011	\$8,193,881	\$0	\$0	\$0	\$0	\$0	\$8,193,881	0.890	\$7,292,554
2012	\$11,705,544	\$0	\$0	\$0	\$0	\$0	\$11,705,544	0.840	\$9,832,657
2013	\$3,511,663	\$0	\$0	\$0	\$0	\$0	\$3,511,663	0.792	\$2,781,237
2014	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.747	\$164,340
2015	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.705	\$155,100
2016	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.665	\$146,300
2017	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.627	\$137,940
2018	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.592	\$130,240
2019	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.558	\$122,760
2020	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.527	\$115,940
2021	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.497	\$109,340
2022	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.469	\$103,180
2023	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.442	\$97,240
2024	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.417	\$91,740
2025	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.394	\$86,680
2026	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.371	\$81,620
2027	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.350	\$77,000
2028	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.331	\$72,820
2029	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.312	\$68,640
2030	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.294	\$64,680
2031	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.278	\$61,160
2032	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.262	\$57,640
2033	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.247	\$54,340
2034	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.233	\$51,260
2035	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.220	\$48,400
2036	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.207	\$45,540
2037	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.196	\$43,120
2038	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.185	\$40,700
2039	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.174	\$38,280
2040	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.164	\$36,080
2041	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.155	\$34,100
2042	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.146	\$32,120
2043	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.138	\$30,360
2044	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.130	\$28,600
2045	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.123	\$27,060
2046	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.116	\$25,520
2047	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.109	\$23,980
2048	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.103	\$22,660
2049	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.097	\$21,340
2050	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.092	\$20,240
2051	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.087	\$19,140
2052	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.082	\$18,040
2053	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.077	\$16,940
2054	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.073	\$16,060
2055	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.069	\$15,180
2056	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.065	\$14,300
2057	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.061	\$13,420
2058	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.058	\$12,660
2059	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.054	\$11,943
2060	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.051	\$11,267
2061	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.048	\$10,630
2062	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.046	\$10,028
2063	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.043	\$9,460
2064	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.041	\$8,925
2065	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.038	\$8,420
2066	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.036	\$7,943
2067	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.034	\$7,493
2068	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.032	\$7,069
2069	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.030	\$6,669
2070	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.029	\$6,292
2071	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.027	\$5,936
2072	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.025	\$5,600
2073	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.024	\$5,283
2074	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.023	\$4,984
2075	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.021	\$4,701
2076	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.020	\$4,435
2077	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.019	\$4,184
2078	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.018	\$3,947
2079	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.017	\$3,724
2080	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.016	\$3,513
2081	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.015	\$3,314
2082	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.014	\$3,127
2083	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.013	\$2,950
2084	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.013	\$2,783
2085	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.012	\$2,625
2086	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.011	\$2,477
2087	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.011	\$2,336
2088	\$0	\$18,000	\$40,000	\$100,000	\$60,000	\$2,000	\$220,000	0.010	\$2,204
Total Present Value of Discounted Costs (Sum of Column (i))									\$22,774,512
Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									
Comments: The expected useful life of the project is over the entire period of analysis, 78 years.									

(1) The incremental change in O&M costs attributable to the project.



Table 18A-4, Event Damage							
Project 4: City of Goleta, San Jose Creek Capacity Improvement and Fish Passage Project							
Hydrologic Event	Event Probability	Damage if Flood Structures Fail	Probability Structural Failure		Event Damage		Event Benefit (Million \$)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
					(c) x (d)	(c) x (e)	(f) – (g)
25-Year	0.04	\$83,000,000	1.0000	0.0000	\$83,000,000	\$0	\$83,000,000
50-Year	0.02	\$102,000,000	1.0000	0.0000	\$102,000,000	\$0	\$102,000,000
100-Year	0.01	\$117,000,000	1.0000	0.0000	\$117,000,000	\$0	\$117,000,000



Table 18B-4, Emergency Response							
Project 4: City of Goleta, San Joase Creek Capacity Improvement and Fish Passage Project							
Hydrologic Event	Event Probability	Emergency Response if Flood Structures Fail	Probability Structural Failure		Emergency Response Costs		Event Benefit (Million \$)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
					(c) x (d)	(c) x (e)	(f) – (g)
25-Year	0.04	\$100,000	1.0000	0.0000	\$100,000	\$0	\$100,000
50-Year	0.02	\$500,000	1.0000	0.0000	\$500,000	\$0	\$500,000
100-Year	0.01	\$1,000,000	1.0000	0.0000	\$1,000,000	\$0	\$1,000,000





Table 18C-4, Net Income							
Project 4: City of Goleta, San Joase Creek Capacity Improvement and Fish Passage Project							
Hydrologic Event	Event Probability	Net Income Loss if Structures Fail	Probability Structural Failure		Lost Net Income		Event Benefit (Million \$)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
					(c) x (d)	(c) x (e)	(f) – (g)
25-Year	0.04	\$339,912	1.0000	0.0000	\$339,912	\$0	\$339,912
50-Year	0.02	\$566,520	1.0000	0.0000	\$566,520	\$0	\$566,520
100-Year	0.01	\$793,128	1.0000	0.0000	\$793,128	\$0	\$793,128



<b>Table 19-4, Present Value of Expected Annual Damage Benefits</b>			
<b>Project 4: City of Goleta, San Joase Creek Capacity Improvement and Fish Passage Project</b>			
<b>(a)</b>	Expected Annual Damage Without Project (1)		<b>\$4,115,000</b>
<b>(b)</b>	Expected Annual Damage With Project (1)		<b>\$0</b>
<b>(c)</b>	Expected Annual Damage Benefit	(a) – (b)	<b>\$4,115,000</b>
<b>(d)</b>	Present Value Coefficient (2)		<b>13.03</b>
<b>(e)</b>	<b>Present Value of Future Benefits</b> <b>Transfer to Table 20, column (e), Exhibit F: Proposal Costs and Benefits Summaries.</b>	<b>(c) x (d)</b>	<b>\$53,636,481</b>

(1) This program assumes no population growth thus EAD will be constant over analysis period.

(2) 6% discount rate; 50-year period of analysis with benefits beginning in year 4